TECHNICAL MANUAL

ALPHA SCINTILLATION DETECTOR
MODEL AC-3

EBERLINE
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SANTA FE NEW MEXICO

SECTION I

PURPOSE AND DESCRIPTION

A. PURPOSE

The AC-3 is a scintillation type alpha probe, designed for use with several EIC survey instruments.

B. DESCRIPTION

The AC-3 consists of a photomultiplier tube, dynode network assembly, scintillation crystal and optical prism, all enclosed in a light-tight housing.

C. 1. ACTIVE AREA: 59 cm^2 (9.1 in^2) within 5-3/4" x 2" sampling area.

2. WINDOW THICKNESS: 1.5 mg/cm^2 aluminized mylar.

3. SCINTILLATOR: ZnS (Ag) powder.

4. EFFICIENCY: 28% for alphas emitted from 59 cm^2 of a distributed area Pu^{239} source.

5. UNIFORMITY: No single reading from a 1" dia. Pu^{239} source deviates more than ±12% from the average reading.

6. OPERATING VOLTAGE: Nominal +1200 volts; however, the optimum voltage depends on phototube characteristics, cable length, and input impedance and sensitivity of counter.

7. OPERATING CURRENT: Nominal 10 microamps.

8. PLATEAU: With 1" dia. Pu^{239} source, typically 200 volts long.

9. TEMPERATURE RANGE: -40° to +140°F.

10. CONNECTOR: Special EIC waterproof connector (CJ-1). Mating connector is EIC Model CP-1.

11. SIZE: Approx. 11" L x 2-3/4" W x 3-1/4" H.

12. WEIGHT: 1 lb. 6 oz.

SECTION II

OPERATION

A. OPERATION

1. After receiving and unpacking, inspect for shipping damage, especially the detector face assembly.

2. Connect the AC-3 to measuring instrument.

3. Determine the operating point on the AC-3 plateau and set to this point. See Step 5.

4. Begin monitoring. Monitoring techniques depend greatly on the situation at hand. Therefore, no specifics will be given. In general, the detector must be held within 1/4 inch of the surface being checked. Holding it in contact with the surface is the most consistent, but this holds the risk of puncturing or contaminating the face.

CAUTION

> Two cautions should be consistently observed while using the AC-3. 1) The cable connecting the AC-3 to an instrument must be hand tight ONLY. Use no tools. 2) The face of the AC-3 is very thin and easily punctured. NEVER set the detector on a sharp object. There is a clear plastic probe face cover supplied with each probe. It is a good policy to get in the habit of never removing this cover unless monitoring is to be done, then replacing it immediately.

5. Determining the Plateau: There are actually two plateaus for each AC-3. Although these are actually the same, the viewpoint is changed, depending upon which type of instrument the probe is being used with. If the instrument has a fixed HV and a variable input sensitivity (RM-3A, PAC-1SAGA, etc.) the plateau is a function of efficiency versus input sensitivity and is dealt with in part 5a. If the instrument has a front HV adjustment (PAC-4S, PRM-4, etc.) the plateau is a function of efficiency versus high voltage. This is the type of curve that is supplied with each AC-3, and is dealt with in part 5b.

a. Turn instrument on. Turn discriminator fully CCW. Place AC-3 over source. Start turning discriminator CW until instrument just starts to count. Record instrument reading and discriminator setting. Turn discriminator 1/16 turn clockwise and again record readings. Continue until discriminator is fully CW or until the plateau is passed and a definite rise in the curve is noted. The ideal operating point is just before this upswing occurs.

b. Turn instrument on. Turn HV adjust fully CCW. Place AC-3 over source. Start turning HV slowly clockwise until the instrument just starts to count. If an electrostatic voltmeter is available, monitor the high voltage. Otherwise, record the HV adjust position. Also record the instrument reading. Turn HV adjust CW 1/16 or 50 volts. Again record reading. Continue until the plateau is passed and a definite rise in the curve is noted.

CAUTION

> The HV capability of the instrument may exceed the tolerance of the AC-3. The HV must NEVER be advanced without watching the instrument reading.

The ideal operating point is 50 to 100 volts (or 1/16 to 1/8) below the point at which the upswing occurs. If no upswing occurs, the operating point should be 100 volts above the knee of the plateau.

SECTION III

MAINTENANCE

A. DISASSEMBLY AND REASSEMBLY

1. FACE PLATE ASSEMBLY: The face plate assembly is retained by six O-ring screws around the edge. Removing these screws releases the entire assembly. To replace the detector face, remove the probe from its cable and remove these six screws. Pull the face assembly from the detector housing, being careful not to allow the optical prism to fall from the housing. Try not to touch the internal parts of the probe. Inspect these parts for fogging or dirt. If cleaning is needed, use a fresh Kleenex to wipe the surfaces clean. USE NO SOLVENTS OF ANY KIND. To reassemble, take the O-ring gasket from the defective face and fit it around the edge of the replacement face. Fit the face carefully into the probe assembly. Replace the six screws, starting all screws before tightening any one, and then tighten evenly all around.

2. PHOTOMULTIPLIER TUBE: The PM tube is removed by unscrewing the cable connector (strap wrench recommended). With the connector out, the tube is retained only by the bond of the optical coupling compound. Remove by pulling GENTLY on the spring while rotating the socket and PM tube with your thumb.

When replacing, make certain the end of the tube is clean and has a sufficient amount of coupling compound (approx. 1/4 teaspoon Dow-Corning 4X). Press in and rotate to firmly seat the tube.

3. TSN-4 DYNODE NETWORK ASSEMBLY: After removing tube and TSN-4 assembly, the TSN-4 can be detached from the tube by an easy back-and-forth and outward pull. The network can be replaced by the same movement inward. Before starting the replacement BE SURE EACH of the tube contact pins will engage in one of the connector receptacles in the TSN-4, or bent tube pins will result. Always handle the TSN-4 by the body - NEVER by the spring.

The TSN-4 has a gain adjustment on the side of the body which is wired so the most gain is obtained from the PM tube in the fully CW position. Any time that the gain adjustment pot is turned, the AC-3 plateau curve will be altered and must be run again. This control is set at the factory for a particular instrument use and should normally be changed only for a different instrument or in case of a photomultiplier replacement. When using with different instruments always try to reach the plateau with the external controls at hand (HV adjust or discriminator) before disassembling probe to adjust the gain control.

B. REPAIR PROCEDURES

1. DETECTOR FACE DECONTAMINATION: Gently brush the face clean with a small camel hair brush. If contamination still clings, wash gently with clean water. DO NOT rub or the thin face may be punctured. If these measures are unsuccessful, the detector face assembly must be changed.

2. PATCHING DETECTOR FACE: If it is suspected that the detector has developed light leaks, small punctures can be repaired with the black lacquer supplied. Light leaks may be located by exposing the detector face to a direct light source and then shadow small areas of the face with the finger. As the shadow passes over the faulty area of the face, the meter reading will change. When the faulty area is located, cover the area with black lacquer. If the patch is complete, the meter reading will drop to zero. (Assuming no background from other causes.) If the patch

is not complete, proceed as outlined above until all leaks are patched.

CAUTION

The patching lacquer will not pass alpha particles and readings must be corrected to compensate for the decrease in detector active area. Keep the patch as small as possible.

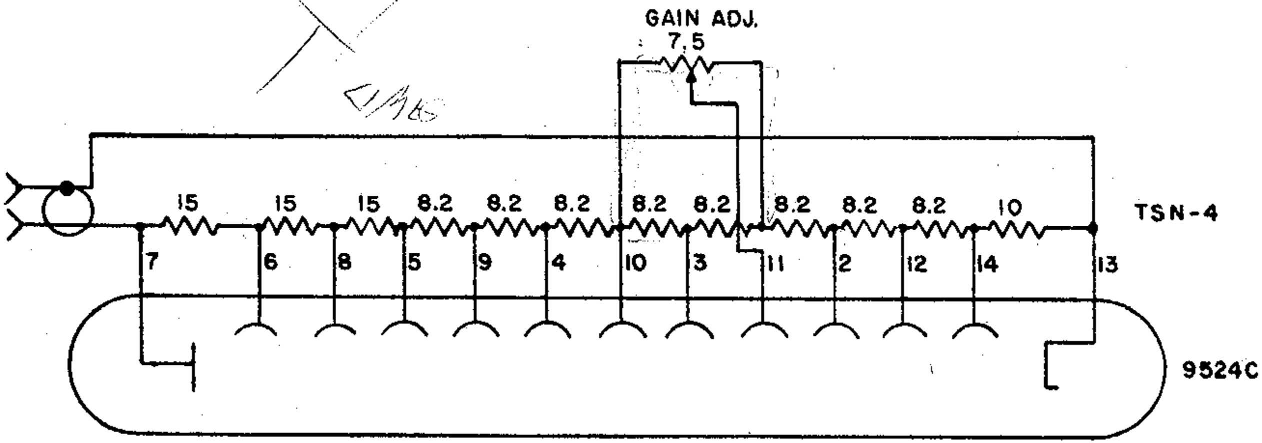
If the face has a great number of light leaks, or the faulty area of the face cannot be located because of saturation, replace detector face assembly.

SECTION IV

PARTS LIST AND DIAGRAM

The AC-3 consists of the following assemblies and parts:

- AC-3 Probe Body
- CJ-1 Connector Assembly
- TSN-4 Dynode Network Assembly
- EMI Type 9524C Photomultiplier Tube, selected for application
- AC-3F Probe Face Assembly
- AC-3FP Probe Face Protector



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